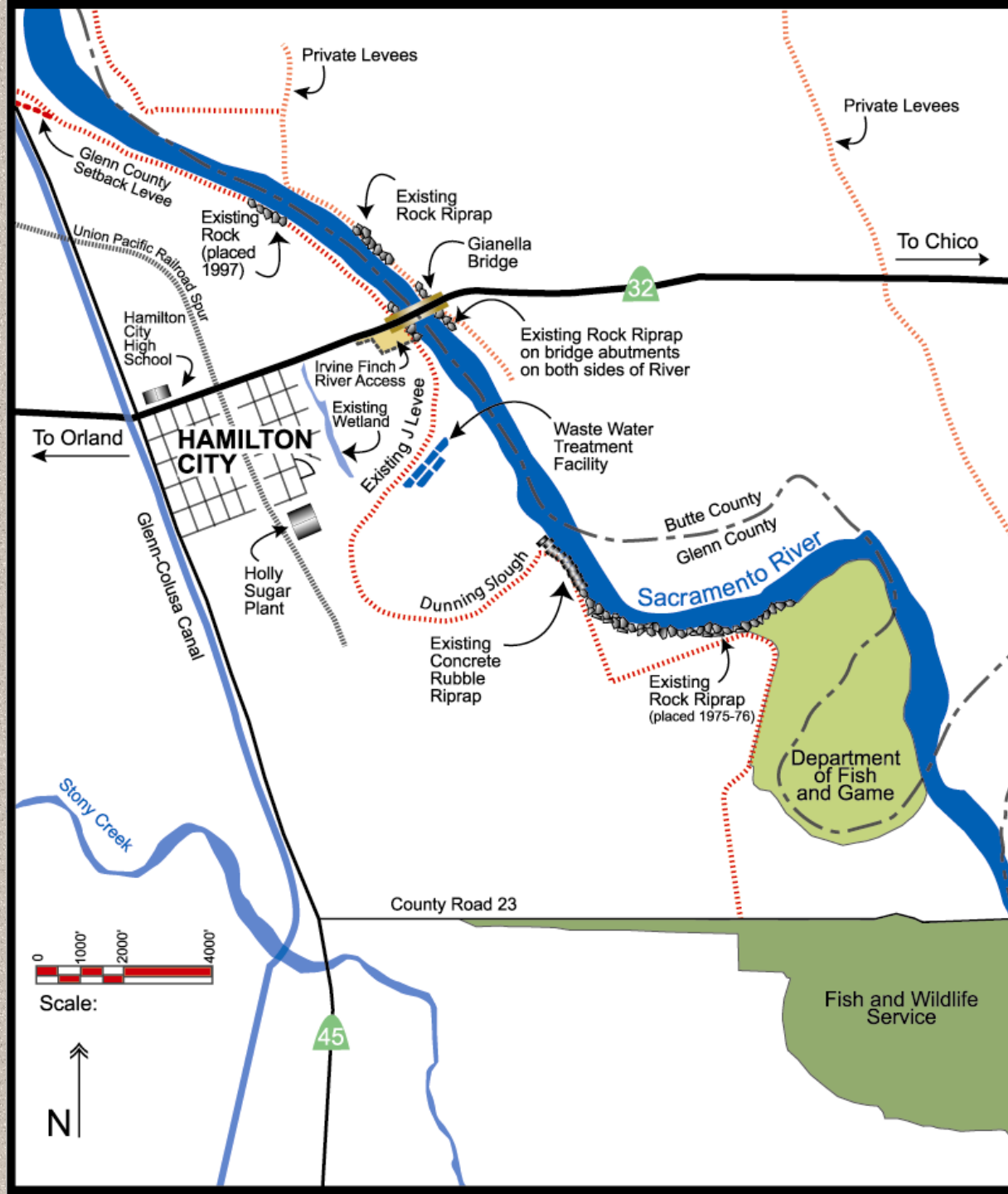
# Flood Damage Reduction and Ecosystem Restoration at Hamilton City, California


**Presented by**

**Scott Miner, Sacramento District**

Study Location

# Study Area


Private Levees
Private Levees
Glenn County Setback Levee
Existing Rock (placed 1997)
Existing Rock Riprap
Gianella Bridge
To Chico
32
Union Pacific Railroad Spur
Hamilton City High School
Irvine Finch River Access
Existing Rock Riprap on bridge abutments on both sides of River
Existing Wetland
Existing J Levee
Waste Water Treatment Facility
To Orland
HAMILTON CITY
Glenn-Colusa Canal
Holly Sugar Plant
Butte County
Glenn County
Dunning Slough
Sacramento River
Existing Concrete Rubble Riprap
Existing Rock Riprap (placed 1975-76)
Department of Fish and Game
Stony Creek
County Road 23
0
1000'
2000'
4000'
Scale:
45
N
Fish and Wildlife Service

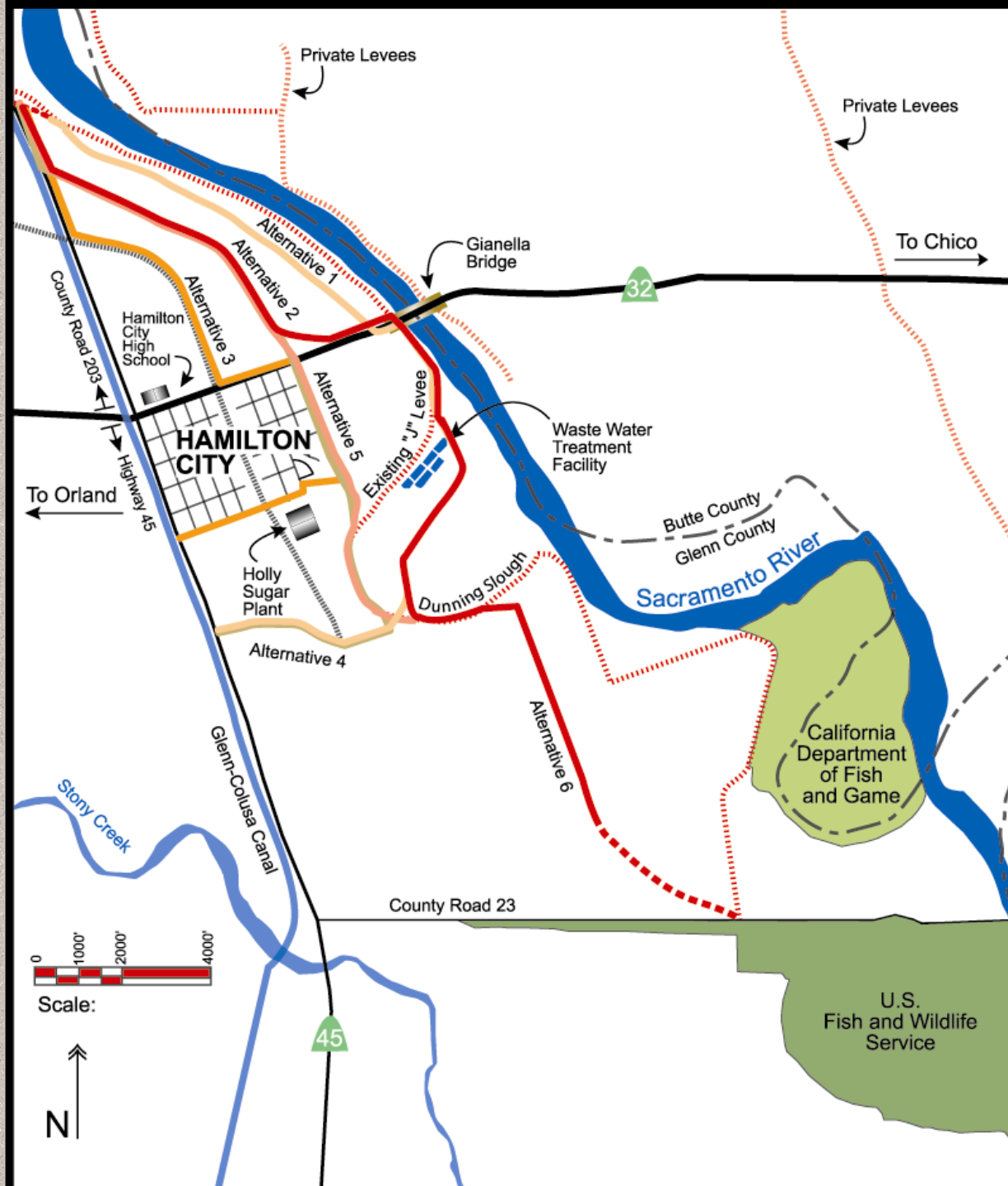
# Problems & Opportunities

- **Problems:**
  - **Flooding**
  - **Loss of riparian and related floodplain habitats**
- **Opportunities:**
  - **Increase Valley Elderberry Longhorn Beetle habitat**
  - **Ecosystem restoration on public, non-profit and agricultural lands**

# Objectives & Measures

| Measures | Objectives | | | | | |
|---|---|---|---|---|---|---|
| | Reduce flood risk | Reduce flood damages | Increase river meander | Increase flooding in floodplain | Increase quantity and quality of habitat | Increase VELB habitat |
| ▪ Raise/Floodproof Community | ✓ | ✓ | | | | |
| ▪ Raise/Floodproof Individual Structures | ✓ | ✓ | | | | |
| ▪ Relocate Community | ✓ | ✓ | | | | |
| ▪ Relocate Individual Structures | ✓ | ✓ | | | | |
| ▪ Acquire Flowage Easements or Fee Title Floodplain Lands | ✓ | ✓ | | | | |
| ▪ Enhance Flood Warning System | ✓ | ✓ | | | | |
| ▪ Modify Existing Reservoirs | ✓ | ✓ | | | | |
| ▪ Construct New Reservoirs | ✓ | ✓ | | | | |
| ▪ Construct High Flow Bypass Channel | ✓ | ✓ | | | | |
| ▪ Increase Flows into Butte Basin | ✓ | ✓ | | | | |
| ▪ Strengthen "J" Levee | ✓ | ✓ | | | | |
| ▪ Construct Setback Levee | ✓ | ✓ | | ✓ | ✓ | |
| ▪ Construct Training Dike | ✓ | ✓ | | | | |
| ▪ Passive Restoration | | | | | ✓ | |
| ▪ Restoration of Native Vegetation | | | | | ✓ | ✓ |
| ▪ Remove Non-native Seed Source | | | | | ✓ | |
| ▪ Remove Non-native Species from Riparian Areas | | | | | ✓ | |
| ▪ Remove Orchards | | | | | ✓ | |
| ▪ Reestablish Hydrologic Connection of River and Floodplain | | | | ✓ | ✓ | |
| ▪ Remove Bank Protection | | | ✓ | ✓ | ✓ | |
| ▪ Passive Removal Bank Protection | | | ✓ | ✓ | ✓ | |

# Alternative Levee Alignments



# Benefits of Alternatives

| | Restoration Zones | | | | | | | Flood Protection | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Alternatives | Zones A1, A2 and A3 | Zone B2 | Zone E | Zone F | Zone G | Zone H | Zone I | Waste Water Treatment Facility | Holly Sugar Plant | Ag Land South of Town |
| Alt. 1 | ✓ | ✓ | ✓ | | ✓ | | | ✓ | ✓ | ✓ |
| Alt. 2 | ✓ | | ✓ | ✓ | ✓ | ✓ | | | ✓ | |
| Alt. 3 | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ | | | |
| Alt. 4 | ✓ | | ✓ | | ✓ | | | ✓ | ✓ | |
| Alt. 5 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | ✓ | ✓ |
| Alt. 6 | ✓ | ✓ | ✓ | | ✓ | ✓ | | ✓ | ✓ | ✓ |

# “Remaining Costs”

**REMAINING COSTS = TOTAL PROJECT COSTS – FDR BENEFITS**

- **Corresponds to “Remaining Benefits” concept used in Separable Costs-Remaining Benefits method of cost allocation**

  **(Remaining Benefits = Total Project Benefits – Separable Costs)**

- **Allows monetary and non-monetary benefits to be merged for Cost Effectiveness Analysis and Incremental Cost Analysis**

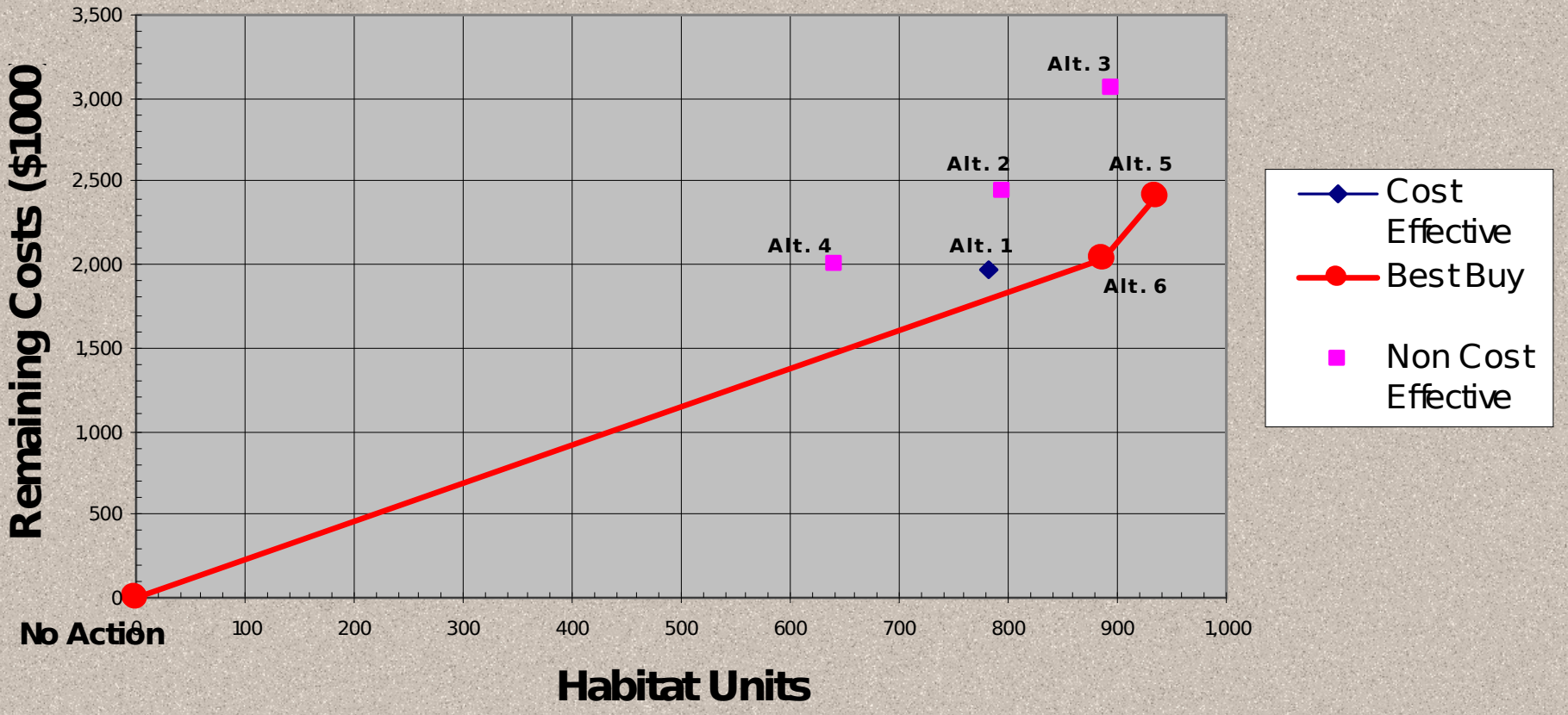
# Cost Effectiveness Screening
# Combined Alternative Plans
# Benefits vs. Total Costs

| Combined Alternatives | Increase in Habitat Units | Flood Damage Reduction Benefits ($1,000) | Total Costs ($1,000) | Cost Effective |
|---|---|---|---|---|
| Alternative 3 | 895 | 428 | 3,483 | No |
| Alternative 5 | 937 | 575 | 2,980 | Yes |
| Alternative 2 | 795 | 437 | 2,878 | No |
| Alternative 6 | 888 | 584 | 2,623 | Yes |
| Alternative 1 | 783 | 583 | 2,547 | Yes |
| Alternative 4 | 642 | 446 | 2,441 | Yes |

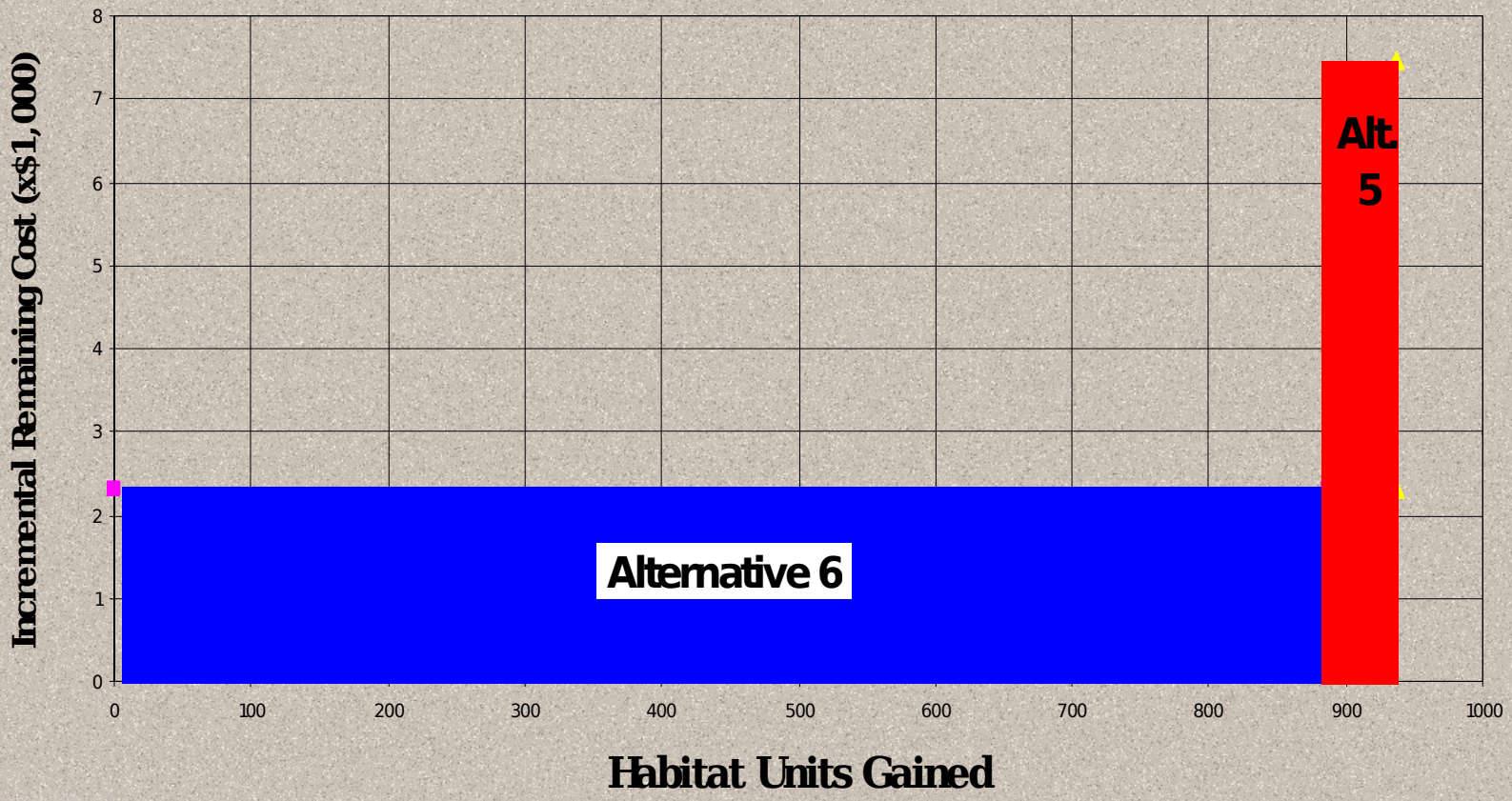
# Cost Effectiveness Screening
# Combined Alternative Plans
# Restoration Benefits vs. Remaining Costs

| Combined Alternatives | Increase in Habitat Units | Flood Damage Reduction Benefits ($1,000) | Total Costs ($1,000) | Remaining Costs ($1,000) | Cost Effective |
|---|---|---|---|---|---|
| Alternative 3 | 895 | 428 | 3,483 | 3,055 | No |
| Alternative 2 | 795 | 437 | 2,878 | 2,441 | No |
| Alternative 5 | 937 | 575 | 2,980 | 2,405 | Yes |
| Alternative 6 | 888 | 584 | 2,623 | 2,039 | Yes |
| Alternative 4 | 642 | 446 | 2,441 | 1,995 | No |
| Alternative 1 | 783 | 583 | 2,547 | 1,964 | Yes |

# Cost Effectiveness Analysis of Alternative Combined Plans



# Incremental Cost Analysis
# "Best Buy" Combined Plans

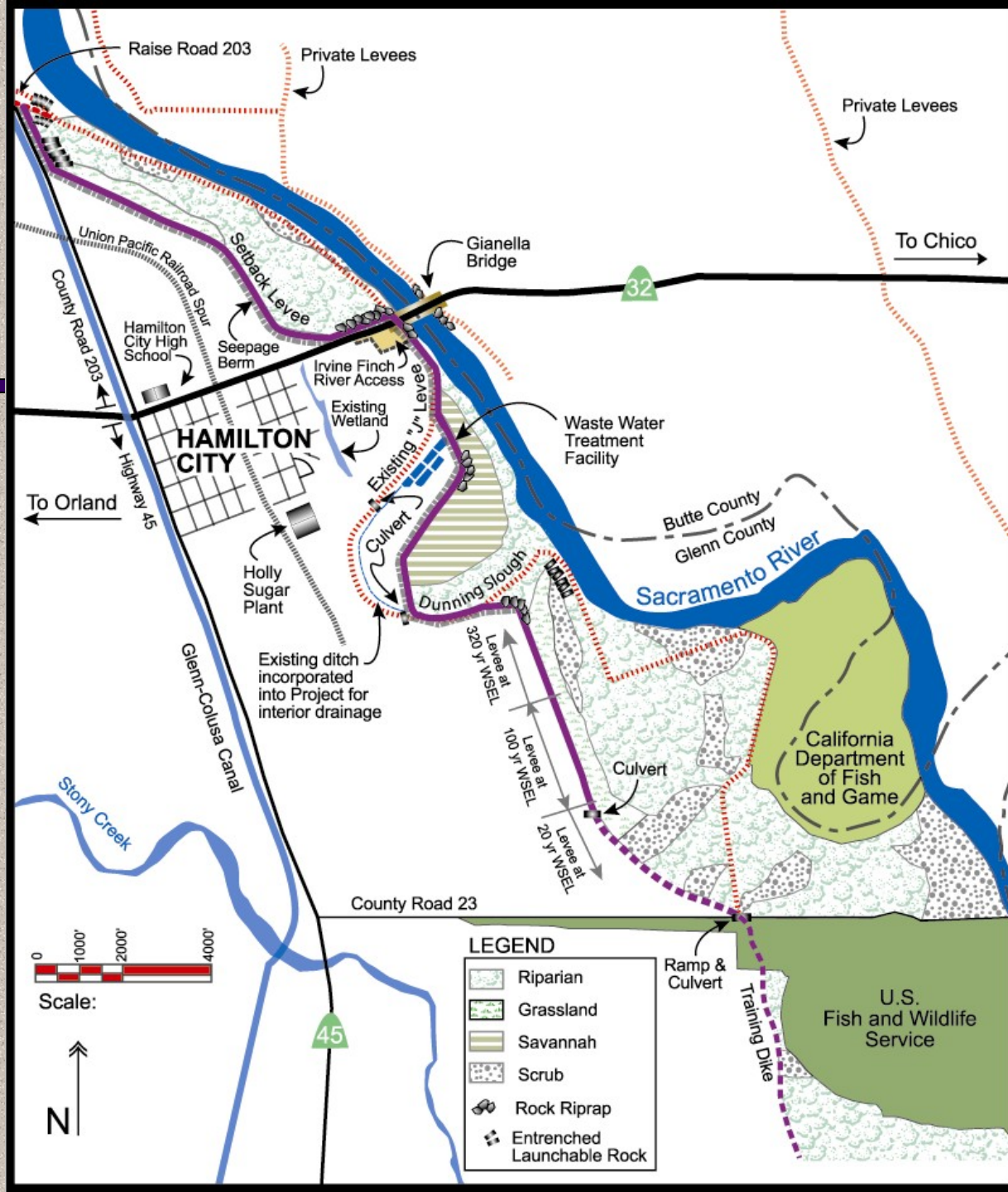


# Trade-off Analysis

| Alternative | AAHU's Gained | Flood Damage Reduction Benefits | Total Annual Cost | Weighted Product | Ranking |
|---|---|---|---|---|---|
| **Alternative 5 Normalized [Actual]** | 1.0000 [937] | 0.9846 [$575K] | -1.0000 [$2980K] | 0.1588 | 2 |
| **Alternative 6 Normalized [Actual]** | 0.9477 [888] | 1.0000 [$584K] | -0.8809 [$2623] | 0.1839 | 1 |
| **Preference Assignme** | 0.50 | 0.08 | 0.42 | | |

# Tentatively Recommended Combined Plan

- **Construct 6.8 miles of setback levee (90% x 75-yr)**
- **Remove most of "J" levee**
- **Restore 1,478 acres of native habitat**



# Project Costs

- **Estimated Total Project First Cost: $43.8 million**
- **Cost Allocation Results (EC 1105-2-219)**
  - **Ecosystem Restoration**
    - **76% of Joint Costs**
    - **90% of Total Costs ($26,600/acre)**
  - **Flood Damage Reduction**
    - **24% of Joint Costs**
    - **10% of Total Costs (1.8 BCR)**

# Lessons Learned

- **Considering a full range of measures and alternatives is vital**
- **CE/ICA using “remaining costs”can supplement trade-off analysis**
- **Preferences used in trade-off analysis should give equal weights to equal costs and monetary benefits**

# Closing Credits

- **Hamilton City Lead Planners**
  - **Mark Cowan**
  - **Eric Thaut**
  - **Alicia Kirchner**
- **Graphics**
  - **Sara Schultz**
- **Sacramento – San Joaquin River Basins Comprehensive Study Project Delivery Team**